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FAMILY LIKENESS OF THE COMETS *i* 1898 (BROOKS), AND 1881 IV (SCHAEBERLE).

In an interesting theorem of mechanics, it is shown that, if a body start from a state of rest, so far as concerns its motion to or from the Sun, and at an infinite distance from the Sun, and be thereafter subjected to the mutual attractions only of the Sun and itself, it will acquire, by reason of these attractions, just sufficient velocity to cause it to describe a parabola having the Sun at its focus. If it start at less than an infinite distance, its velocity at any point in its orbit will be less than that which obtains in a parabola for the same distance from the Sun, and in this case its path will be an ellipse. And if it start with initial velocity towards the Sun, the orbit which it will then describe will be an hyperbola.

These propositions have well-known applications in the case of comets. A comet may be situated so far from all attracting bodies, as to be next to free from the influence of any predominating force. Suppose a comet so situated to drift into the region where the Sun exercises what little predominating force there is. Then, if the comet is nearly or quite in a state of rest, so far as concerns its motion to or from the Sun, it will begin to gravitate towards the Sun, and will describe about it an orbit which will be indistinguishable from a parabola. If, in its movement towards the Sun, its velocity becomes accelerated from any cause other than the mutual attractions of itself and the Sun, as, for example, by the action of the planets, its orbit about the Sun will be changed from a parabola to an hyperbola; and, on the other hand, if its velocity is diminished, its orbit will be changed from a parabola to an ellipse. In the latter case, the comet will become periodic, and the shortness of its period will depend upon the extent to which its velocity has been diminished. In this way, the planet *Jupiter* is responsible for the remarkable changes that have taken place in the orbits of a considerable number of comets. At present there are known about twenty-five comets, with periods less than that of *Jupiter*, and with aphelion distances not very different from the mean distance of this planet from the Sun. These comets have become permanent members of the solar system by reason of *Jupiter's* attraction, and although they move in very different orbits, they are designated as *Jupiter's* Family of Comets.

In another sense we also have families of comets. Recurring to the principles above, it is evident, that if there are two comets in the same region of space at an indefinitely great distance from the Sun, which begin to gravitate towards the Sun, they will move in the same general direction and at the same general rate. One may reach its point of nearest approach to the Sun many years before the other, but on comparing their orbits, it will be found that they have essentially the same dimensions and essentially the same situation in space. Comets having orbits with such relations are said to belong to the same family, indicating thereby that they at one time were situated in the same region of space, and were affected by the same general conditions of rest or motion.

Such a relation exists between the comet discovered October 20th, by Dr. BROOKS, of Geneva, New York, and that discovered July 13, 1881, by Professor SCHAEBERLE, at Ann Arbor. From my observations of October 21st, 23d, and 25th, I have computed the elements of Comet BROOKS with the following results:

$$\begin{array}{rl} T = & 1898.13518 \text{ Gr. M. T.} \\ \left.\begin{array}{r} \omega = \\ \Omega = \\ i = \end{array} \begin{array}{rrr} 123^\circ & 22' & 21''.3 \\ 96 & 10 & 6.2 \\ 140 & 18 & 58.1 \end{array}\right\} & \begin{array}{c} \text{Ecliptic and} \\ \text{Mean Equinox of 1898.0} \end{array} \\ \log q = & 9.878746 \\ \text{O}-\text{C:} & \Delta\lambda' \cos\beta' = +0''.6, \quad \Delta\beta' = -1''.6. \end{array}$$

As the result of a definitive investigation of the orbit of Comet SCHAEBERLE, Dr. STECHERT arrived at the following parabolic elements as being those which represent the observations as satisfactorily as any system that can be obtained.

$$\begin{array}{rl} T = & 1881, \text{ August } 22.3431935 \text{ Berlin M. T.} \\ \left.\begin{array}{r} \omega = \\ \Omega = \\ i = \end{array} \begin{array}{rrr} 122^\circ & 7' & 18''.61 \\ 97 & 2 & 36.93 \\ 140 & 13 & 54.04 \end{array}\right\} & \text{Mean Equinox, 1881.0} \\ \log q = & 9.8017757 \end{array}$$

It is to be noted that the longitudes of the nodes and the inclination of these two orbits are nearly the same, consequently the planes of the two orbits are nearly coincident. Moreover, the dimensions of the orbits and the positions on their planes, as determined by q and ω, are almost the same. Hence, the two comets describe essentially the same path in space, and the question of their identity arises.

The Comet 1881 IV was under observation from July 13 to

October 18, 1881. During this time it described a heliocentric arc of 167°, namely, 77° before and 90° after perihelion passage. The length of this arc is sufficient to afford a very accurate determination of the orbit, and to give us confidence in the results obtained by Dr. STECHERT. The most probable elements which he obtained were hyberbolic, differing so little, however, from the parabolic ones given above, that he finally selected the latter as the definitive elements. In his attempts to vary the eccentricity, he found that the observations could be represented fairly well by all orbits from an ellipse corresponding to a periodic time of 100,000 years to an hyperbola having an eccentricity equal to 1.0003. If the orbit is included within these limits, as seems reasonably certain, the Comet 1881 IV is not one of short period, and cannot have returned by this time. Moreover, Comet BROOKS has been following closely the ephemeris computed from my elements, and has not given any indication of departure from parabolic motion. These circumstances preclude the possibility of these comets being identical. They may certainly, however, be said to belong to the same family.

W. J. HUSSEY.

LICK OBSERVATORY, November 15, 1898.

THE SMALL BRIGHT NEBULA NEAR *MEROPE*.

In No. 3018 of *Astronomische Nachrichten*, Professor BARNARD called attention to a small nebula near the star *Merope*, which he had discovered by visual observation with the 12-inch telescope of the Lick Observatory. He describes the nebula as round, bright — though not easily visible on account of its proximity to the star,— and apparently not connected with the nebulous system of the *Pleiades*. It turned out that the nebula had previously been photographed; but its character is sufficiently different from other nebulosities in the same region to justify its treatment by BARNARD as an individual nebula.

This nebula is well shown on some photographs which I have recently obtained with the 3-foot reflector presented to the Lick Observatory by Mr. CROSSLEY. My attention was, in fact, attracted by it before I recalled the note by Professor BARNARD, mentioned above. Though small, it is by far the brightest nebula in the *Pleiades*. Of the plates which I have obtained, the one which shows it best received the shortest exposure (fifteen minutes). I have no doubt that it can be photographed with the CROSSLEY reflector in five minutes, or even in less time than this.